



## Education

### Program/Abstract # 58

#### **A forward genetic screen as a developmental biology laboratory exercise for undergraduates identifies gene candidates that regulate embryonic CNS development in *Drosophila***

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Central nervous system (CNS) development relies upon the ability of thousands of neurons to extend axons that interconnect precisely with their targets. As such, axon guidance is a complex and dynamic mechanism that depends upon a wide range of ligand-receptor complexes that regulate either axonal repulsion or axonal attraction toward a specific target. To further understand the mechanism of axon guidance, a discovery-based Developmental Biology Laboratory course (BSC 469L) at The University of Southern Mississippi involving undergraduates was initiated to identify novel genes regulating axon guidance using a forward genetic screen. In wild-type *Drosophila* embryos, Fasciculin II (Fas II) is expressed in a stereotypic pattern within all axons of the CNS. This protein mediates the fasciculation of developing axons in the ventral nerve cord and plays a fundamental role in guiding axonal branching points throughout the CNS. By comparing the CNS expression pattern of Fas II among wild-type embryos with that of embryos carrying a range of chromosomal deficiencies, we identified a number of probable gene candidates within a large genomic interval on the second chromosome that potentially regulate axon guidance. We obtained either 28 mutant alleles or RNAi transgenic lines for the 28 probable gene candidates identified within the deleted chromosomal interval to determine whether one or more of these genes regulate axon guidance. As a result, we are pursuing the descriptive and functional characterization of two new genes we identified from the screen that are essential for regulating the proper formation of the ventral nerve cord.

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### Program/Abstract # 59

#### **Engage and explore: Carrying out small and publishable research in the classroom**

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Research has shown that for students regardless of gender and race, exposure to research enhances confidence, critical thinking skills, knowledge retention and career outlooks. However, faculty at primarily teaching institutions often lack the time and resources necessary to carry out major research projects. The author has

successfully used *Drosophila melanogaster* in the teaching classroom to engage students in publishable research using the following approaches: (1) think of what your interests and expertise are in; (2) research for a small but original project; (3) outline your expectations for the students regarding the project; (4) tailor the methodology to what is practical for you and the students; (5) be enthusiastic about the project and engage yourself; and (6) collaborate and ask for expert opinion whenever needed. We studied the effects of fruits with different pHs on the longevity and fertility of the wild type and various mutants. The project was both simple and original in concept, and allowed the collection of a large amount of data with a relatively small investment of time using commonly available classroom equipment.

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### Program/Abstract # 60

#### **Use of the zebrafish as a teaching and research tool at a primarily undergraduate institution**

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Zebrafish are ideal model organisms for use at a primarily undergraduate institution due to their ease of care and breeding as well as the many areas of biology which currently employ the zebrafish for study. I have used zebrafish to both instruct students in basic biological concepts and conduct research focused on reproductive and developmental biology. Teaching: embryonic protein samples have been used to demonstrate the relationship between protein expression and phenotype during a one session freshman level laboratory experience. Specifically, through an analysis of pictures from early embryonic development and banding patterns from SDS-PAGE experimentation (from embryos at the same points in development as the pictures) students consider differential protein expression and its impact on phenotype. Research: students have evaluated the impact of Endocrine Disruptors (EDs), herbicides and pesticides, on oocyte maturation which is a marker of meiotic progression. At environmentally relevant doses most EDs had a negative impact on maturation. Current research is aimed at examining the molecular phenotype associated with this negative effect. Specifically, we are attempting to generate a transgenic Zebrafish expressing a meiosis specific gene linked to GFP. This will allow for studies on the timing of spindle assembly and dynamics during in-vitro maturation of oocytes and an evaluation of the impact of maturation in the presence of EDs. Thus far, a BAC containing the gene of interest has been successfully characterized and modified,

through homologous recombination, to contain a galk cassette. Further modification with a GFP cassette is underway.

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#### Program/Abstract # 61

##### **Eukaryon: An undergraduate scholarship journal that supports inquiry-based pedagogy and strengthens a community of undergraduate scholars**

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Undergraduate research and inquiry-based pedagogy are becoming increasingly crucial components in college and university curricula in the United States. Providing undergraduates with the opportunity to publish their scholarship serves as a pedagogical tool to increase scientific literacy and motivation for scientific careers. Spurred by an NSF-CCLI grant in 2004, the Lake Forest College Biology Department accordingly developed a peer-reviewed undergraduate research journal of life science scholarship entitled *Eukaryon* ([www.lakeforest.edu/eukaryon](http://www.lakeforest.edu/eukaryon)). In each annual issue, *Eukaryon* publishes scholarship in any sub-discipline of the life sciences that students have produced within the department's research-rich undergraduate classrooms and faculty labs, in a variety of scientific and journalistic formats. Here, we first detail three aspects of the journal's development: 1) how it is exclusively governed, published, and financed by undergraduates; 2) how data from a three-year follow up survey demonstrates maintenance of publication selectivity, and assesses student familiarity of journal and of scientific publication process; and 3) how the board is continually expanding new publication categories to best reflect a dynamic biology curriculum and to promote development of effective leadership within its student scholars. Given the rapid success *Eukaryon* has enjoyed at our institution, we encourage the adaptation and implementation of such journals at undergraduate institutions that further strengthen their community of students as scholars and their inquiry-based pedagogy. (Supported by NSF-CCLI).

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#### Program/Abstract # 62

##### **Service learning with GEISHA and other online databases**

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The GEISHA (Gallus Expression In Situ Hybridization Analysis) initiative at the University of Arizona has partnered with undergraduate students and faculty at two other universities (BYU, Clemson) to create a unique service-learning opportunity for students. Students work with local mentors and peer teachers to learn to curate entries for the GEISHA database from the primary literature. Students learn to locate specific papers in PubMed, and locate information within the results and methods sections of those papers on a specific gene's expression and the probe used to detect it. They find the DNA sequence for that probe or a comparable cDNA in the genomic databases (NCBI, ensembl), and may be required to use primer sequences to extract specific probe sequence from a cDNA sequence. They learn to parse figure legends for information on

staging and anatomical locations of expression, get exposure to developmental biology, and work with an editor to polish a submission for public consumption. In pre- and post-surveys students reported an average gain of 1.6 points or 40% (1=0%, 2=25%, 3=50%, 4=75%, 5=>95%) in one semester in five adaptable academic skills related to this project. In addition, faculty mentors reported that this gave interested undergraduate students some research-related experience and was a good screening tool to identify motivated, independent students for future lab research projects. We are working to improve and expand this collaborative opportunity between GEISHA and undergraduate developmental biology instructors and their students. Our web location is <http://geisha.arizona.edu>. This work is supported by NIH 1P41HD064559 to PBA.

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#### Program/Abstract # 63

##### **Using writing to teach developmental biology, using developmental biology to teach writing: Assessment tools**

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Writing at the University of Redlands is taught via a Writing Across the Curriculum program. Students complete two writing-intensive courses, one at the lower level (WA) and one in the junior or senior year that concentrates on writing within the major discipline (WB). Both are taught by faculty of all disciplines who are trained in a three day workshop. Biology 348, the upper division developmental biology course, is taught as a WB course. A variety of writing assignments are used. Students write one full lab report, with revision, with other lab reports concentrating on specific writing skills often deficient in student reports. They also write a term paper discussing two primary sources in detail. This paper is peer reviewed and revised. Students collaborate in groups of four to deliver 80 minute lectures based on the chapters corresponding to these topics. There is also a journal club component in lecture, with a writing exercise designed to teach them reading skills and presentation exercises designed to teach critical thinking skills. Initial assessments of the course have indicated an increase in critical thinking skills, an improved ability to read the primary literature, and a greater understanding of experimental methods, design and developmental concepts. This poster will describe current attempts to develop assessment tools to evaluate the effectiveness of the course.

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#### Program/Abstract # 64

##### **Demystifying and humanizing research through intensive analysis of primary literature—Testing the C.R.E.A.T.E. approach in diverse student populations and topic areas**

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Traditional Biology teaching rarely emphasizes the creativity of science careers or encourages deep analysis of material. To address this deficiency, we previously developed C.R.E.A.T.E. (Consider, Read, Elucidate hypotheses, Analyze data, and Think of the next Experiment). C.R.E.A.T.E. students achieve deeper understanding of the evolution of projects by analyzing series of papers from individual labs, and gain novel insights into 'the research life' from authors' thoughtful responses to a student email survey. At CCNY, an MSI, C.R.E.A.T.E. students made gains in critical thinking ability, science attitudes and epistemological beliefs. To test C.R.E.A.T.E. more